REMARKS

Status of the claims:

Claims 1-10 are pending with claim 10 having been withdrawn from a prior restriction requirement. Thus, claims 1-9 are ready for further action on the merits. Reconsideration is respectfully requested in light of the following remarks.

Rejections under 35 USC §§102 and 103

Claims 1-3, 5, 6, 8, and 9 are rejected under 35 §102(e) as being anticipated by Mauk '088 (US Patent No. 5,828,088).

Claims 4 and 7 are rejected under 35 §103(a) as being unpatentable over Mauk '088.

These rejections are traversed for the following reasons.

Present Invention

The present invention as recited in claim 1 relates to a III-V compound semiconductor having a first layer that comprises a first III-V compound semiconductor expressed by the general formula $In_uGa_vAL_wN$ where $0 \le u \le 1$, $0 \le v \le 1$, $0 \le w \le 1$, and $u+v+w=1$, a pattern on said first layer from a material different not only from said first III-V compound semiconductor but also from a second III-V compound semiconductor hereinafter described, and a layer on said first III-V compound semiconductor and said pattern from said second III-V compound semiconductor expressed

by the general formula $In_xGa_yAl_zN$ where $0 \leq x \leq 1$, $0 \leq y \leq 1$, $0 \leq z \leq 1$, and $x+y+z=1$, wherein the full width at half maximum of the (0004) reflection X-ray rocking curve of said second III-V compound semiconductor is 700 seconds or less regardless of the direction of X-ray incidence, and the compound semiconductor is formed by a vapor phase epitaxy method.

Disclosure of Mauk '088

Mauk '088 discloses a device structure and crystal growth process for making the same. The single-crystal semiconductor layers are formed over metal or composite layers. The metal layers function as buried reflectors to enhance the performance of LEDs, solar cells, and photodiodes. The structures are made by a modification of a well-established metallic solution growth process. The lateral overgrowth process can be enhanced by imposing an electric current at the growth interface (termed liquid-phase electro-epitaxy). However, the use of an electric current is not crucial. The epitaxial lateral overgrowth technique was also applied to silicon growth on metal-masked silicon substrates.

Mauk '088 fails to disclose a compound semiconductor that is formed by a vapor phase epitaxy method.

Removal of the Rejection over Mauk '088

In the present invention, after a mask pattern is formed on a first III-V compound semiconductor layer, then a second III-V compound semiconductor layer is formed (selective growth) thereon. By employing this method, thin film having improved crystal quality can be obtained. In the vapor growth of GaN, although the threading dislocation is stopped by a mask, new crystal defects occur, that is, inclination of the crystal axis in the selective growth layer occur.

Mauk '088 discloses a device structure, whereby single-crystal semiconductor layers are formed over metal layers (masks). The metal layers function as buried reflectors to enhance the performance of LEDs, etc. However, Mauk '088 is silent on dislocations or new crystal defects generated in the case of GaN epitaxial growth by use of a vapor phase epitaxy (VPE) method.

Mauk '088 describes that the mask must be compatible with the substrate at process temperatures which may be as high as 850°C for epitaxial lateral overgrowth of GaAs-based materials and even several hundred degrees higher for epitaxial lateral overgrowth of silicon, silicon carbide, or gallium nitride. (Please see column 6, lines 11-15 in Mauk '088) However, as for GaN, Mauk '088 provides no concrete description. Thus, one

cannot arrive at this instant invention from the disclosure of Mauk '088.

Applicants herein explain the difference between a liquid phase epitaxy (LPE) process and a vapor phase epitaxy (VPE) method, in the growth of GaN crystal by referring to two documents enumerated below.

Unlike with GaAs, GaN crystals decompose at temperatures above 1700°C before melting, and it has been difficult to grow GaN crystals by an LPE process.

In 1997, Yamane et al. (Chem. Mater. 1997, 9, pp. 413-416), a copy of which is attached, reported a preparation of GaN crystal at 500-750°C by using a Na flux to lower the melting point. More recently, Kawamura et al. (Jpn. J. Appl. Phys. Vol. 42 (2003) pp. L4-L6), also attached, report a growth of GaN crystal using an LPE process on MOCVD-GaN thin film, by applying Yamane's method. Please note that Kawamura et al. was published well after the filing date of the instant invention.

Kawamura et al. describe the reduction of dislocation density of GaN crystals by the LPE growth technique, but the reduction is due to the utilization of the LPE growth technique itself. Kawamura et al. is completely silent about the utilization of any mask.

Kawamura et al. state that the GaN crystal grown was black in the early stage, suggesting that the GaN crystal had many

inclusions, or was otherwise impure (this includes vacancies), and the GaN crystal became transparent in the later growth period. (Please see Page L5, left column, lines 1-5 in Kawamura et al.). Accordingly, from a reading of Kawamura et al., which indicates the state of the art in 2003 (after the instant invention), one or ordinary skill in the art would have recognized the difficulties in obtaining a thin film having no defect by LPE method (as is done in the present invention).

In the present invention, threading dislocations in the substrate can be stopped by a mask, and moreover, new crystal defects, that is, inclination of the crystal axis in the selective growth layer can, be suppressed as well.

These defects observed in a crystal grown by the VPE method are not recognized in the LPE method. Mauk '088 describes the utilization of mask in the growth of Ga-As based materials by the LPE method, but as for gallium nitride, there is neither concrete disclosure nor suggestion.

GaAs and GaN have different properties in the growth conditions of LPE and VPE, such as heat-stability, melting behavior, etc. For these reasons, Mauk '088's teaching about the LPE of GaAs is not directly applicable to VPE of GaN. Moreover, nowhere in Mauk '088 is these motivation to use a mask in order to reduce the new crystal defects in the growth of GaN by VPE method.

Thus, Mauk '088 cannot anticipate the instant invention because Mauk '088 simply fails to disclose the elements of the claimed invention.

Moreover, Applicants assert that the Examiner has failed to make out a *prima facie* case of obviousness with regard to the 35 USC §103(a) rejection over Mauk '088. Three criteria must be met to make out a *prima facie* case of obviousness.

1) There must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings.
2) There must be a reasonable expectation of success.
3) The prior art reference (or references when combined) must teach or suggest all the claim limitations.

See MPEP §2142 and *In re Vaeck*, 20 USPQ2d 1438 (Fed. Cir. 1991). In particular, the Examiner has failed to meet the third element to make a *prima facie* obviousness rejection. As explained above, Mauk '088 fails to disclose or suggest the utilization of mask in the growth of Ga-As based materials by the LPE method.

For these reasons, the rejections are inapposite. Withdrawal of the rejections is warranted and respectfully requested.

With the above remarks, it is believed that the claims, as they now stand, define patentable subject matter such that

passage of the instant invention to allowance is warranted. A Notice to that effect is earnestly solicited.

If any questions remain regarding the above matters, please contact Applicant's representative, T. Benjamin Schroeder (Reg. No. 50,990), in the Washington metropolitan area at the phone number listed below.

Pursuant to the provisions of 37 C.F.R. §§ 1.17 and 1.136(a), Applicants respectfully petition for a five (5) month extension of time for filing a response in connection with the present application. The required fee of $1970.00 is attached hereto.

If necessary, the Commissioner is hereby authorized in this, concurrent, and future replies, to charge payment or credit any overpayment to Deposit Account No. 02-2448 for any additional fees required under 37 C.F.R. §§ 1.16 or 1.17; particularly, extension of time fees.

Respectfully submitted,

BIRCH, STEWART, KOLASCH & BIRCH, LLP

By________________________________
Andrew D. Meikle, #32,868

ADM/TBS/mua

P.O. Box 747
Falls Church, VA 22040-0747
(703) 205-8000

Attachments: Yamane et al., Chem. Mater. 1997, Vol. 9, pp. 413-416
Kawamura et al., Jpn. J. Appl. Phys. Vol. 42 (2203) pp. L4-L6